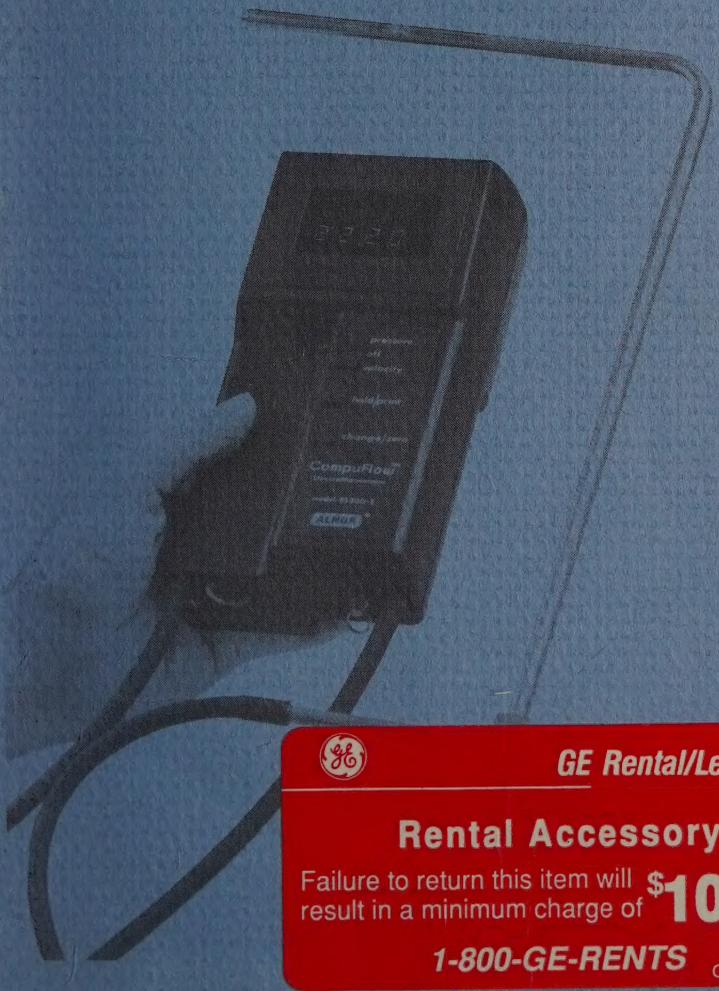
ALNOR®

CompuFlow®
ElectroManometer
model 8530D-I
OWNER'S MANUAL



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SAFETY NOTICE

All necessary precautions must be observed when operating the CompuFlow ElectroManometer in the vicinity of moving equipment such as motors and blowers. The user must exercise care to ensure that the probe or the instrument does not interfere with any moving equipment.

CAUTION

The operational range of the meter 0 to 122° F (– 18 to 50°C) must not be exceeded. Reading inaccuracies may result if the temperature range is exceeded. NOTE: Accuracy not specified below 32°F.

The ElectroManometer is **NOT** designed for gas mixtures other than air. Use with liquids, and corrosive or other dangerous gas mixtures is not recommended, and is at the user's risk.

WARNING

If the instrument is not to be used for more than two months, remove the batteries from the instrument and store them separately in a plastic container to avoid damage from possible leakage.

Maximum differential pressure to the ElectroManometer must not exceed 5 psi (138 inches of water, or 34,470 Pascals). Higher pressures may permanently damage the instrument.

WARRANTY

Your warranty information and reply card are enclosed elsewhere in this package. After locating this material, please return the reply card and retain the remaining warranty information.

WARNING: Opening or otherwise attempting to service your Alnor instrument will void the warranty. Please read the warranty statement carefully.

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GENERAL DESCRIPTION

The CompuFlow ElectroManometer is a hand held instrument capable of measuring differential pressures from 0 to 20 inches of water (or 0 to 5000 Pascals with the press of a button). This battery powered unit is microprocessor based, and will also measure standard air velocity when used with a Pitot-static probe. The velocity measuring range is 0 to 9990 ft./min. (or 0 to 91 m/s). Measurements can be frozen on the display using a hold feature. The choice of English or metric units is available to the user at the touch of a button allowing output in Pascals, inches of water, m/s or feet/minute. An output port for use with Alnor's MicroPrinter is standard.

Up to 250 readings can be automatically averaged by this instrument. The instrument's response to fluctuating inputs can be changed by the user. Five time responses are available. Depending on the input value, the resolution of the instrument is automatically adjusted. Resolution is approximately 0.004 inches of water below 1 inch of water and 0.01 inches of water from 1 to 20 inches of water. In metric mode, resolution is 1 Pascal below 250 Pascals and 10 Pascal from 250 to 5000 Pascals.

Three NiCd rechargeable batteries are used as the power supply and provide up to six hours of continuous operation (without optional MicroPrinter connected). Recharge time is 12 to 14 hours.

The ElectroManometer kit comes in a convenient carrying case that is foam padded for maximum protection. The carrying case holds the meter, 12 inch Pitot-static probe, two 8 foot lengths of rubber tubing and a battery charger. Additional compartments are available for optional accessories such as the MicroPrinter, printer paper and extra batteries.

PREPARATION FOR USE
(MEASURING WITH THE PITOT-STATIC PROBE)

1. After opening the carrying case, remove the meter. Check the charge on the batteries by switching the instrument to PRESSURE mode. For the first three seconds, the display will indicate the approximate charge life on the batteries.

   00 — indicates batteries should be recharged
   01 — indicates at least one hour battery life

   If the display is blank, the batteries are probably completely discharged. If this is the case, or if a 00 appears, recharge the instrument for 12 to 14 hours before making any use of the instrument. If the MicroPrinter is not connected to the ElectroManometer, a full battery charge will provide six hours of continuous service. Battery life will be reduced if the MicroPrinter is connected. See the MicroPrinter owner's manual for further details on battery life with printer connected.

2. To charge the batteries, plug the charger into the instrument's charge connector as shown in Figure 1. The opposite end is connected to any 115v 50/60 Hz outlet. The instrument must be turned off to charge the batteries. A false reading on battery charge may be obtained if the instrument is turned on during the charging operation. Once a 00 battery charge reading occurs, the instrument should be recharged for the full 12 to 14 hour period to ensure maximum battery life. If the battery charger is removed before the 12 to 14 hour recharge is complete, initial battery charge indication may be incorrect. If this is the case, leave the instrument on for 60 seconds and then recheck battery life by turning the instrument off and then on to PRESSURE mode. Battery life indication should now be correct.

3. Remove the Pitot-static probe and rubber tubing from the carrying case. Remove the protective caps from the probe and save them. Attach a section of flexible tubing to the static pressure port, and another to the total pressure port, shown in Figure 2.

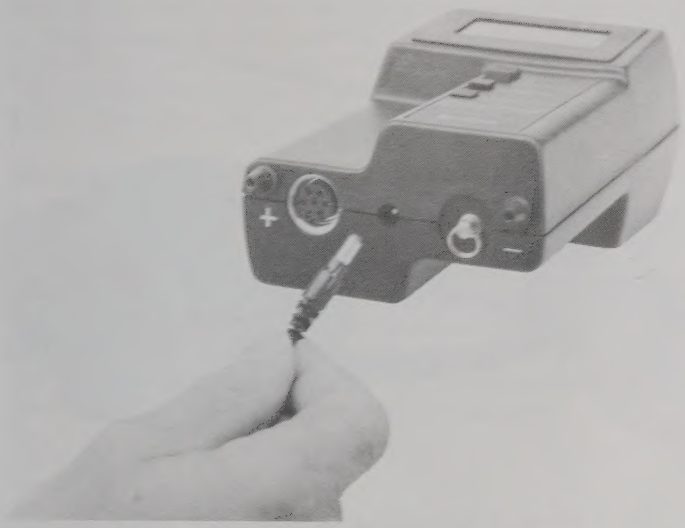


Figure 1. Battery Charger Insertion

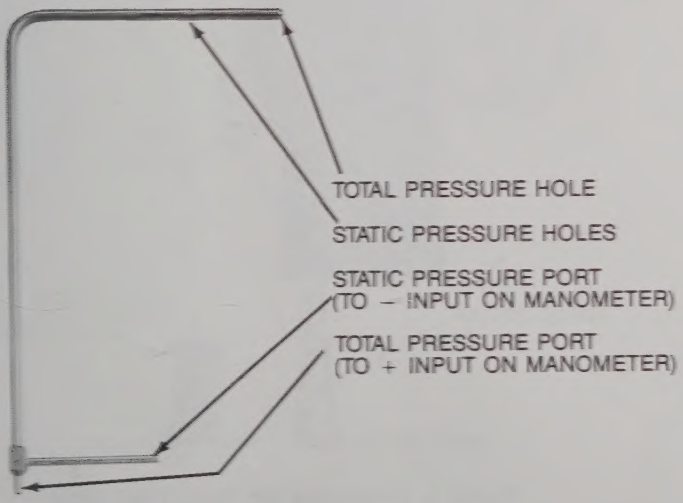


Figure 2. Pitot-static Probe

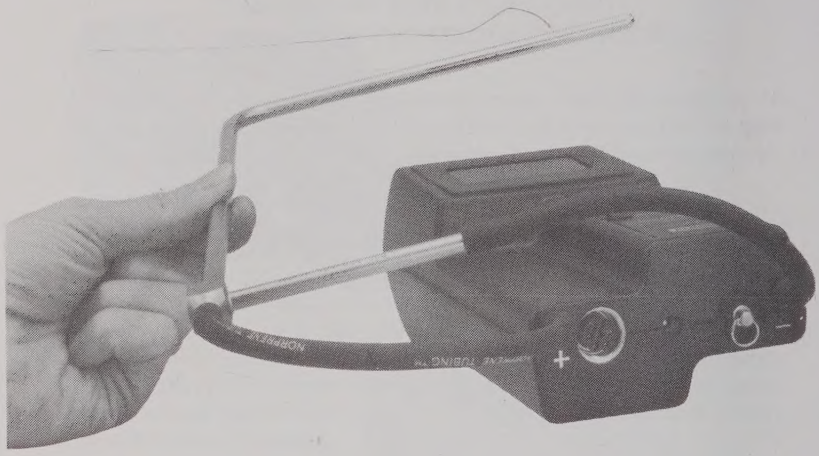


Figure 3. Connecting the Pitot-static Probe

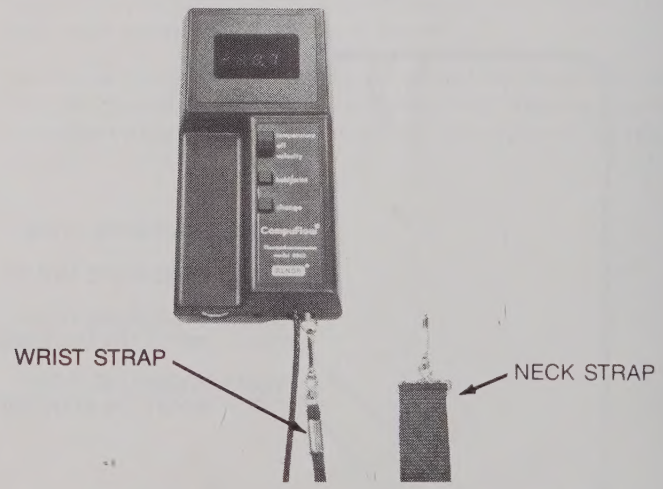


Figure 4. Connecting the Neck/Wrist Strap

4. Identify the + and − pressure ports at the bottom of the meter. As shown in Figure 3, attach the tubing from the total pressure port of the Pitot-static probe to the + port of the ElectroManometer. Attach the remaining tubing from the static pressure port of the Pitot-static probe to the − port of the ElectroManometer. Make sure all tubing connections are tight.

5. The neck strap should be connected as shown in Figure 4. If preferred, the wrist strip included in the kit can be used instead.

6. If the CompuFlow MicroPrinter or RS232 Interface Module is to be used, connect it to the ElectroManometer at this time. This connection must be made before turning on power to the ElectroManometer. As shown in Figure 5, grasp the printer connector at the black collar and align the keyway. Gently push the connector forward about 1/4 inch. Lock the connector in place by rotating the silver collar clockwise about two full turns.

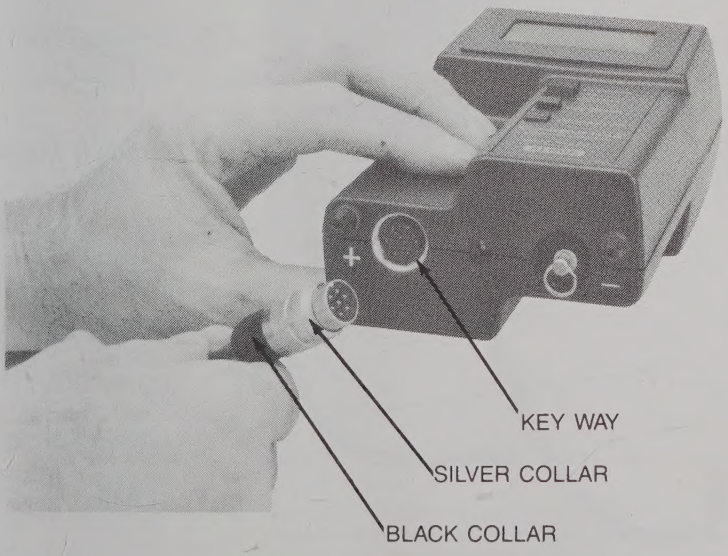


Figure 5. Printer Connector Insertion

OPERATION

The operating controls of the CompuFlow ElectroManometer Model 8530 are located on the front of the instrument. These controls are illustrated in Figure 6 and described in Table 1.

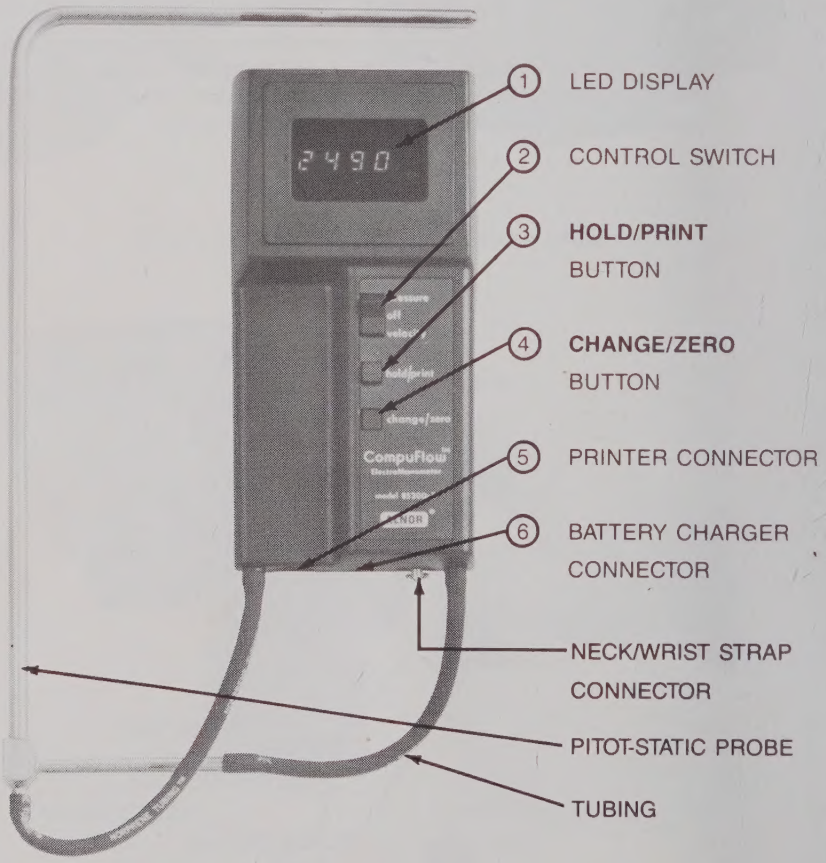


Figure 6. Front View of Instrument

Table 1. Description of Instrument Controls

INDEX NO.	NAME	DESCRIPTION
1	LED Display	The pressure or air velocity reading is displayed on the 4-digit LED (Light Emitting Diode) display. This display is also used to show the average reading and the number of readings in the average. During pressure measurements, the display shows the units (inches of) H_2O or Pa (Pascals). In velocity mode, the units FPM or m/s are shown. The units are changed as described below under CHANGE/ZERO push button. Measurements can be frozen as described under HOLD/PRINT push button. Battery voltage, zeroing and time constant indication are also shown by the LED display.
2	Control Switch	The three position control switch turns the power on or off, and selects pressure or air velocity as the measurement parameter. In the middle position, the power is off and any information stored in the unit is lost. In the upper position, the instrument is in pressure mode. H_2O or Pa will show on the display as verification of this condition. In the lower position, the instrument is in velocity mode and the display will show either FPM or m/s.
3	HOLD/PRINT Push button	The HOLD/PRINT push button can be pressed briefly (less than 1 sec.) to freeze the display. When the push button is depressed a second time, the display will again show the value of pressure or velocity that is currently being measured. This action also enters the value previously frozen into the average memory. Up to 250 readings can be averaged by this procedure. If the HOLD/PRINT button is held down for more than three seconds, the average of all the previously "held" readings is displayed. The memory is cleared by turning the instrument off. (See Control Switch.) If the CompuFlow MicroPrinter is connected, displayed values will be printed each time the HOLD/PRINT button is depressed to release the display.
4	CHANGE/ZERO Push Button	The CHANGE/ZERO button provides five different functions. UNITS CHANGE Whenever the unit is not in hold, the CHANGE button can be pressed for about one second and then released to change the unit of measurement from (inches of) H2O to Pa while in pressure mode. In velocity mode, it will change the unit of measurement from FPM to m/s. *Note that the alternate symbol does not come on until the push button is released.* The instrument can be changed between English and metric units at any time the HLD indicator is not on.

Table 1. Description of Instrument Controls (Cont.)

INDEX NO.	NAME	DESCRIPTION
4	CHANGE/ZERO Push Button (Cont.)	AVERAGE COUNT If the CHANGE button is pressed for two seconds or less when the HLD (hold) LED is on, the number of readings which have been put into the average will be displayed. Use caution; holding CHANGE for more than 3 seconds with the HLD indicator on will erase the reading. READING DELETION If the CHANGE button is held for more than three seconds when the HLD indicator is on, the last reading shown on the display will be erased, and not entered into the average. ZERO If the CHANGE button is held depressed at the time the instrument is turned on, the instrument will be zeroed. When zeroed, the instrument reads the current differential pressure as zero. Care should be taken to assure that no pressure difference exists between the + and − ports before zeroing the meter. Once the zeroing process has started (after the CHANGE button is released) 000.0 will be shown on the display. During this time make sure that the input pressure does not change from zero. During this period do not move probe or instrument as this may cause non-zero pressure to be applied as input. Once the 000.0 disappears from the display the zeroing process is complete. If in pressure mode, battery indication will be displayed followed by pressure readings. If in velocity mode, velocity readings will be displayed. TIME CONSTANT If the CHANGE button is held down for more than 1 second (while the HLD indicator is not on), the display will cycle through the available time constant settings. A display of .0.0.1 will provide a very fast response. A display of .0.0.5 will provide a somewhat slower response. Release the CHANGE button when the desired setting is seen on the display.
5	Printer Connector	A locking connector attaches the MicroPrinter to the meter.
6	Battery Charger Connector	The 2 pin connector attaches the battery charger to the instrument. Charge the instrument only from the battery charger included with your unit.

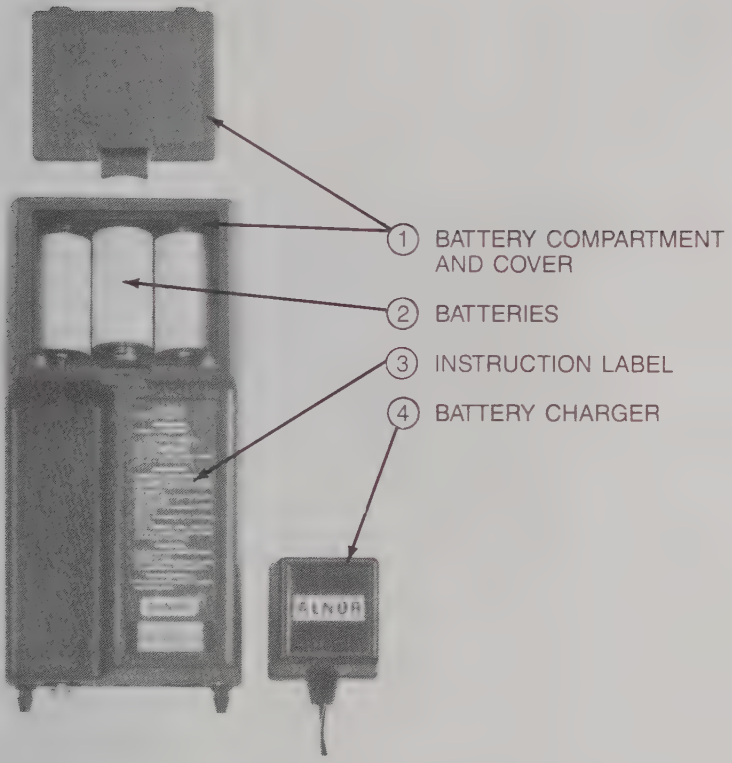


Figure 7. Rear View of Instrument

Table 2. Description of Features at Rear of Instrument

INDEX NO.	NAME	DESCRIPTION
1	Battery Compartment with Cover	The battery compartment located behind the display accommodates three NiCd batteries to power the instrument. The user should inspect the batteries at least every two months for leakage. To open the cover, press forward on the tab marked OPEN and then pull up.
2	Batteries	Three 1.2 volt NiCd rechargeable batteries supply the power to the instrument. C size heavy duty alkaline batteries may be used in an emergency. DO NOT CONNECT THE CHARGER IF ALKALINE BATTERIES ARE INSTALLED.
3	Instruction Label	A brief set of operating instructions is printed on the back of the label for quick reference.
4	Battery charger	4.5 VDC, 180 mA charger.

A. STEP BY STEP OPERATION - VELOCITY MEASUREMENT

1. Connect the Pitot-static probe to the unit as described in the PREPARATIONS FOR USE section of this manual.

2. Plug the CompuFlow MicroPrinter into the ElectroManometer (if desired).

3. Put the instrument into pressure mode to check the battery voltage. Do this by depressing the control switch to the upper position. If the display shows 01 for the first three seconds, battery charge is sufficient for at least one hour's use. Proceed to the next step. If the display shows a 00, recharge the batteries before taking any measurements. A blank display likely means that the batteries are fully discharged. If this is the case, turn the unit off and recharge the batteries for 12 to 14 hours.

4. Before taking velocity measurements, the instrument must be zeroed. To zero the instrument, turn the instrument off. Make sure there is no flow past the Pitot-static probe. Also verify that none of the tubing is pressurized by accidental squeezing.

NOTE: MAKE SURE THE PROTECTIVE CAPS ARE REMOVED FROM THE PITOT-STATIC PROBE BEFORE GOING TO THE NEXT STEP. THE SYSTEM MAY BE PRESSURIZED WITH THE PROTECTIVE CAPS IN PLACE. THEY MUST BE REMOVED BEFORE ZEROING. IF AMBIENT TEMPERATURES AROUND THE INSTRUMENT ARE CHANGING, PERIODICALLY CHECK THE ZERO AND REPEAT STEPS 4 & 5 AS REQUIRED.

5. Depress the CHANGE/ZERO button before turning the instrument on. While depressing the CHANGE/ZERO button, put the instrument into velocity mode by depressing the control switch to the lower position. Release CHANGE button. Instrument is checking zero while 000.0 shows on the display. Make sure no pressure is applied to the instrument while the display reads 000.0. After about 5 seconds, the display will indicate velocity.

6. The FPM LED will light and the instrument will drift to 0 FPM reading if there is no flow past the probe.

7. If m/s rather than FPM is preferred, push the CHANGE button for approximately one second. The LED indicator should change after the button is released.

NOTE: IF THE CHANGE BUTTON IS HELD DOWN FOR MORE THAN ONE SECOND, THE DISPLAY WILL ROTATE THRU THE AVAILABLE TIME CONSTANT SETTINGS. SEE NEXT STEP.

8. If the readings are changing too fast or too slow, the display can be adjusted for the particular flow condition that is present. Hold the CHANGE

button down until the display begins to rotate thru the following numbers:

.0.0.1
.0.0.2
.0.0.3
.0.0.4
.0.0.5

A display of .0.0.1 will provide a fast response. A display of .0.0.4 or .0.0.5 will provide a slow response typical of inclined oil-filled manometers. (See the Specifications section for the exact definition of each display setting.)

Release the CHANGE button when the desired setting is seen on the display. The response setting chosen is stored automatically in the instrument's memory and will be used until another selection is made. Even if the instrument is turned off, the response setting is remembered.

9. Take readings as required. Under-range or negative readings are indicated by . . 0 0. Similarly, over-range readings are indicated by 9.9.9 9.

10. To freeze the reading on the display, push the HOLD button for about 1 second, and release. The HLD (hold) LED will come on. To release the display, push the HOLD a second time. The HLD LED light will go off. (If the MicroPrinter is attached, the value displayed will be printed. The velocity pressure will also be printed out.)

NOTE: UNDER-RANGE VALUES (..00) WILL BE AVERAGED AS ZERO, WHILE OVER-RANGE VALUES (9.9.9 9) CAN NOT BE AVERAGED OR HELD.

11. If the average of a number of readings is required, turn the instrument off for at least 1 second and then back on before starting. This will clear its memory. Next freeze the display on the reading to be entered into the average by pressing the HOLD button for about 1 second and then releasing. The HLD (hold) indicator will now be on.

12. If it is desired to know the number of readings in the average, the CHANGE button may now be pressed for 2 seconds or less. The number which appears on the display indicates the number of readings in the average including the reading currently held. (Caution: holding the CHANGE button for more than 3 seconds will erase the current reading.)

13. If it is desired to NOT enter into the average the reading currently held on the display, it may be erased by pressing and holding the CHANGE button. Initially the display will show the number of readings in the average including the currently held reading. After approximately 3 seconds, this number will be reduced by 1 indicating that the last last held reading has been erased and will not be entered into the average. When the CHANGE button is released, the unit will return to normal operation.

14. To enter the reading currently held on the display into the average, press and release the HOLD button a second time. The HLD indicator will now go off, and normal operation will occur.

15. To read out the final average, make sure the instrument is not in HLD. Push the HOLD/PRINT button for at least three seconds (until the HLD LED turns on). The number shown is the average. (If the Microprinter is attached, the average will be printed.) To determine the number of readings in the average, push the CHANGE button down after the HLD LED is on. (Caution: holding CHANGE down for more than 3 seconds will cause the average value to be lost.)

    NOTE: ONCE THE AVERAGE IS DISPLAYED, THE INSTRUMENT SHOULD BE TURNED OFF TO TAKE ADDITIONAL READINGS. THE AVERAGE WILL BE LOST. INTERMEDIATE AVERAGES CANNOT BE SHOWN.

    (At this point, if the CHANGE button is held for more than 3 seconds, then released, the display will clear. However, no additional readings can be held, printed, or averaged unless the instrument is turned off and back on.)

16. The reading from the ElectroManometer is in "Standard" velocity. To determine the true velocity, multiply by the correction factor shown in Figure 8. The correction factor is based on the pressure and temperature of the air at the location of the Pitot-static probe.

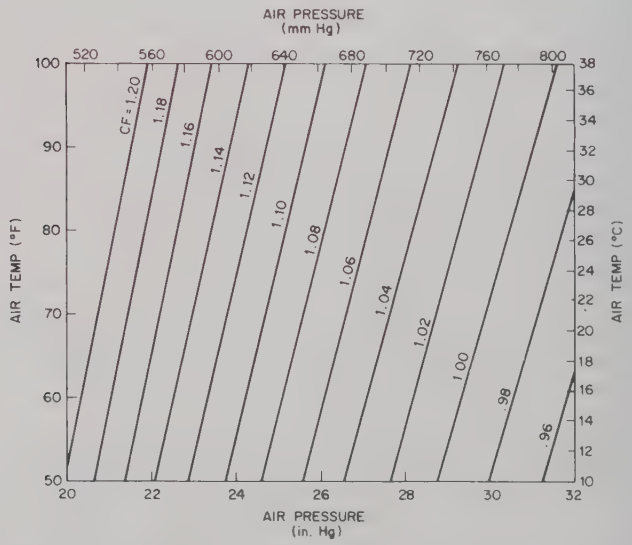


Figure 8. Correction Factors for Non Standard Conditions

B. STEP BY STEP OPERATION - PRESSURE MEASUREMENT

1. Connect the Pitot-static probe (or alternate device) to the unit as described in the PREPARATION FOR USE section of this manual. If a device other than a Pitot-static probe is used, verify that the positive pressure side is connected to the + port of the ElectroManometer.

2. Plug the CompuFlow MicroPrinter into the ElectroManometer (if desired).

3. Before taking pressure measurements, the instrument must be zeroed. To zero the instrument, verify that the ElectroManometer is turned off. Make sure there is no flow past the Pitot-static probe (or alternate device). Also verify that none of the tubing is pressurized by accidental squeezing.

NOTE: MAKE SURE THE PROTECTIVE CAPS ARE REMOVED FROM THE PITOT-STATIC PROBE BEFORE GOING TO THE NEXT STEP. THE SYSTEM MAY BE PRESSURIZED WITH THE PROTECTIVE CAPS IN PLACE. THEY MUST BE REMOVED BEFORE ZEROING. IF AMBIENT TEMPERATURES AROUND THE INSTRUMENT ARE CHANGING, PERIODICALLY CHECK THE ZERO AND REPEAT STEPS 3 & 4 AS REQUIRED.

4. Depress the CHANGE/ZERO button before turning the instrument on. While depressing the CHANGE/ZERO button, put the instrument into pressure mode by depressing the control switch to the upper position. Release CHANGE button. Instrument is checking zero while 000.0 shows on the display. Make sure no pressure is applied to the instrument while the display reads 000.0.

5. After about five seconds, the display will briefly show the condition of the batteries. If the display shows 01 for about three seconds, battery charge is sufficient for at least one hour's use. Proceed to the next step. If the display shows a 00, recharge the batteries before taking any measurements. A blank display likely means that the batteries are fully discharged. If this is the case, turn the unit off and recharge the batteries for 12 to 14 hours.

6. The H_2O LED will light and the instrument will drift to a zero reading if there is no pressure applied to the meter.

7. If Pa rather than H_2O is preferred, push the CHANGE button and release after approximately one second. The LED indicator should change. If it does not change, repeat the process.

NOTE: IF THE CHANGE BUTTON IS HELD DOWN FOR MORE THAN ONE SECOND, THE DISPLAY WILL ROTATE THRU THE AVAILABLE TIME CONSTANT SETTINGS. SEE NEXT STEP.

8. If the readings are changing too fast or too slow, the display can be adjusted for the particular flow condition that is present. Hold the CHANGE button down until the display begins to rotate thru the following numbers:

.0.0.1
.0.0.2
.0.0.3
.0.0.4
.0.0.5

A display of .0.0.1 will provide a fast response. A display of .0.0.4 or .0.0.5 will provide a slow response typical of inclinded oil-filled manometers. (See the Specifications section for the exact definition of each display setting.)

Release the CHANGE button when the desired setting is seen on the display. The response setting chosen is stored automatically in the instrument's memory and will be used until another selection is made. Even if the instrument is turned off, the response setting is remembered.

9. Take readings as required. Under-range readings are indicated . . 0 0 . Similarly, over-range readings are indicated by 9.9.9 9 .

10. To freeze the reading on the display, push the HOLD button for about 1 second, and release. The HLD (hold) LED will come on. To release the display, push the HOLD a second time. The HLD LED light will go off. (If the MicroPrinter is attached, the value displayed will be printed. The velocity pressure will also be printed out.)

NOTE: UNDER-RANGE VALUES (..00) WILL BE AVERAGED AS ZERO, WHILE OVER-RANGE VALUES (9.9.9 9) CAN NOT BE AVERAGED OR HELD.

11. If the average of a number of readings is required, turn the instrument off for at least 1 second and then back on before starting. This will clear its memory. Next freeze the display on the reading to be entered into the average by pressing the HOLD button for about 1 second and then releasing. The HLD (hold) indicator will now be on.

12. If it is desired to know the number of readings in the average, the CHANGE button may now be pressed for 2 seconds or less. The number which appears on the display indicates the number of readings in the average including the reading currently held. (Caution: holding the CHANGE button for more than 3 seconds will erase the current reading.)

13. If it is desired to NOT enter into the average the reading currently held on the display, it may be erased by pressing and holding the CHANGE button. Initially the display will show the number of readings in the average including the currently held reading. After approximately 3 seconds, this number will be reduced by 1 indicating that the last held reading has been

erased and will not be entered into the average. When the CHANGE button is released, the unit will return to normal operation.

14. To enter the reading currently held on the display into the average, press and release the HOLD button a second time. The HLD indicator will now go off, and normal operation will occur.

15. To read out the final average, make sure the instrument is not in HLD. Push the HOLD/PRINT button for at least three seconds (until the HLD LED turns on). The number shown is the average. (If the Microprinter is attached, the average will be printed.) To determine the number of readings in the average, push the CHANGE button down after the HLD LED is on. (Caution: holding CHANGE down for more than 3 seconds will cause the average value to be lost.)

NOTE: ONCE THE AVERAGE IS DISPLAYED, THE INSTRUMENT SHOULD BE TURNED OFF TO TAKE ADDITIONAL READINGS. THE AVERAGE WILL BE LOST. INTERMEDIATE AVERAGES CANNOT BE SHOWN.

(At this point, if the CHANGE button is held for more than 3 seconds, then released, the display will clear. However, no additional readings can be held, printed, or averaged unless the instrument is turned off and back on.)

16. For convenience, a number of conversion factors for pressure are provided in Table 3.

Table 3. Conversion Factors

TO OBTAIN	Multiply quantity below by the following factor	
	In H_2O (4° C)	Pascals
Atmos	2.458×10^{-3}	9.869×10^{-6}
Bars	2.491×10^{-3}	10^{-5}
Dynes/sq.cm.	$2.491 \times 10^{+3}$	10
In of Hg (0° C)	7.355×10^{-2}	$2.953\ 10^{-4}$
In of H_2O (4° C)	1	4.014×10^{-3}
Kgs/sq.meter	25.40	1.019×10^{-1}
Lbs/sq.in.	3.6127×10^{-2}	1.4503×10^{-4}
Lbs/sq.ft.	5.202	2.089×10^{-2}
Torr (mm Hg)	1.868	7.502×10^{-3}
Microns	$1.868 \times 10^{+3}$	7.502
Pascals	$2.491 \times 10^{+2}$	1

LIST OF MODELS AND PARTS

Listed below are common models and parts related to the CompuFlow ElectroManometer.

Table 4. List of Models and Parts

PART NO.	MODEL NO.	KIT DESCRIPTION
634-613-000	8530	CompuFlow ElectroManometer with Pitot-Static probe, battery charger and case
638-493-000	8520	CompuFlow MicroPrinter
639-000-000		RS232 Interface Module
		PARTS LIST
634-634-000		Pitot-static probe (12″)
534-493-130		Carrying case
459-000-000		NiCd 1.2V C-size battery
459-009-004		Battery Charger
372-000-000		Hose - one 8ft length, 3/16″ I.D. (2 pieces required)
370-000-001		Neck Strap
534-493-208		Wrist Strap
116-159-035		Instruction Manual 8530

PERFORMANCE CHECK

When checking the performance of the instrument, verify that the instrument has been properly zeroed. Although the zero setting is stored by the instrument, changes in room temperature may require that the instrument be periodically re-zeroed. If the ElectroManometer's calibration is to be checked, a reference pressure standard at least 5 times more accurate than the ElectroManometer should be used. This instrument senses pressure differential, so the calibration should be checked in pressure mode, not in velocity mode. If the instrument is checked against a velocity standard such as a thermal-anemometer, the user should be aware that a Pitot-static probe and pressure sensor generally have better resolution and accuracy at velocities above 2000 FPM than do thermal-anemometers. The thermal-anemometer generally has better resolution and accuracy than a Pitot-static probe at velocities below 600 FPM.

It is also important to remember that environmental conditions such as temperature, pressure, humidity and turbulence can have very different effects on the measuring result for different instrument types. These effects must be considered when comparisons are made.

Air velocity is rarely distributed evenly in a duct or in an open air stream. The velocity will generally be higher in the middle of the air stream than at the periphery due to the friction at surfaces or to free standing air. This may cause discrepancies when comparing different instruments in the "same" air stream. The user should also realize that insertion of a probe in a channel of relatively small cross-sectional area changes the air velocity from the undisturbed case.

If the instrument seems to be out of calibration, contact your local Alnor distributor or Alnor Instrument Co. If it becomes necessary to return the unit for repair, see the WARRANTY/REPAIR INFORMATION FORM and INSTRUCTIONS FOR RETURN pages of this manual.

MAINTENANCE

The Pitot-static probe should have its ports checked for dirt accumulation. If the sensing holes should become clogged, gently clean them using a soft bristle brush and denatured or iso-propyl alcohol. Allow the probe to dry thoroughly before using it with the meter. Always replace the protective caps on the Pitot-static probe when not in use.

Inspect the tubing periodically for pin hole leaks. Replace the tubing if necessary. It is recommended that rubber tubing be used with an inside diameter of 3/16 inches. Vinyl tubing may be used, but this tubing may be more difficult to remove from the hose barbs of the ElectroManometer.

If the unit becomes soiled, the case may be cleaned using a cloth moistened in water. Do not allow liquids inside the case or to come in contact with the control switches on the front of the unit.

The batteries should be examined at least every two months for signs of corrosion. To open the battery cover, press forward on the tab marked OPEN and then pull up. Remove the batteries if there is corrosion on the ends of the batteries or anywhere in the compartment. Clean the affected parts with a clean cloth moistened with water only. Allow the parts to dry thoroughly and reinstall the batteries. The instrument should be stored with the batteries fully charged. However, if the instrument is not to be used for more than two months, remove the batteries and store them separately in a plastic container to avoid damage to the instrument from possible leakage.

NOTE: WHEN INSTALLING BATTERIES, OBSERVE THE POLARITY MARKINGS SHOWN ON THE BOTTOM OF THE BATTERY COMPARTMENT.

If the battery life consistently falls short of 6 hours, the batteries may have to be exercised by completely discharging them. (Batteries can be discharged by leaving instrument on until the display goes blank. Do not leave the instrument on with the display blank for a long period, since the batteries may then no longer take a charge). The batteries should then be recharged over a period of 12 to 14 hours. This process of completely discharging and recharging the batteries may have to be repeated two or three times. Battery life should then return to 6 hours after a full charge. If not, the batteries should be replaced.

NOTE: EXCEPT FOR THE BATTERIES, THERE ARE NO USER MAINTAINABLE PARTS INSIDE THE INSTRUMENT. DO NOT OPEN THE METER CASE.

Table 5. Troubleshooting Procedures

SYMPTOM	POSSIBLE CAUSES AND CORRECTIVE ACTION
No display	Switch is not fully on. Batteries are fully discharged. Recharge batteries.
Display is dim	Batteries are low. Recharge batteries.
Readings do not change	HLD indicator is on. Depress HOLD button to turn HLD indicator off. Input pressures are out of range. Adjust input pressures to within specification.
Display shows . . 0 0	Negative differential pressure is applied to the instrument. Check + and – hose connections. After zeroing, instrument may drift from .000 to ..00 which is normal.
Display shows 9.9.9 9	Input pressure exceeds specifications. Reduce input pressure. In velocity mode, a switch from FPM to m/s may solve the problem.
Measurement is erratic	Flow field is unstable or very turbulent. Adjust instrument time constant. Probe is not held steady. Secure probe. Tubing is being moved or vibrated. Secure rubber tubing.

SYMPTOM	POSSIBLE CAUSES AND CORRECTIVE ACTION
Erroneous readings	Pitot-Static probe holes are plugged. Inspect holes and clean if necessary.
	Tubing is leaking. Check tubing connection. Look for pin hole leaks in tubing. Replace tubing if necessary.
	Instrument is operated beyond allowable temperature limits. Allow instrument to come within allowable temperature range.
	Instrument was not zeroed or was zeroed incorrectly. Rezero instrument. See page 8 for correct procedure.
	Instrument zero has drifted. Re-zero instrument. See page 8 for correct procedure.
	User chose incorrect units. Check indicator display and verify choice.
Batteries do not last 6 hours	Cycle batteries from complete discharge to full charge two or three times.
	Batteries are old. Replace batteries.
	Printer is attached to instrument. Disconnect printer when not in use. Battery life is reduced when the printer is attached.
Printer does not print	Printer was plugged in after instrument was turned on. See MicroPrinter manual.
	Batteries are low. Recharge batteries.
Instrument does not average	HLD indicator light must not be lit when averaging. See Operation section of this manual.
Hold button does not work	Input pressure or velocity is over range. Adjust input pressure or velocity per specifications.

THEORY OF OPERATION

GENERAL

The ElectroManometer can be divided into the main functional blocks shown in Figure 9. Each performs a key role in the operation of the instrument. All of the functional components are mounted on two printed wiring boards located within the instrument housing.

SENSOR

The heart of the instrument is a piezoresistance sensor. This sensor has a membrane with resistors imbedded in it. The resistors are arranged in a bridge configuration. When a differential pressure is applied across the membrane, the sensor outputs a voltage that is proportional to the applied pressure.

MULTIPLEXER

Under the control of the microprocessor, the multiplexer connects one of several inputs (sensor bridge, reference voltage, battery voltage and circuit offset voltages) to the digitizer. Before entering the digitizer, the inputs are amplified.

DIGITIZER

This section converts the signal to numeric (digital) data, to be used by the microprocessor in mathematical calculations.

MICROPROCESSOR

A microprocessor analyzes the output signal from the sensor and converts it to either "H_2O or Pa when in pressure mode. If the user selected velocity mode, the microprocessor first converts the input signal to pressure and then to velocity according to the formulas below:

English units $\quad FPM = 4005 \sqrt{\text{in. of water}}$

Metric units $\quad m/s = 1.29 \sqrt{\text{Pascals}}$

The above equations assume that;

1) A standard Pitot-static probe with a K factor of 1.00 is connected to the meter.

2) The air is at standard conditions. That is, the air density is .075 lb/cu ft or 1.2 kg/cu m.

To read true air velocity, a density correction factor must be applied as discussed in the OPERATION section of this manual.

MEMORY

The software program that is used by the microprocessor is stored in permanent memory. In addition to the program, the instrument's calibration, zero setting and the response time constant setting are also stored in memory.

LED DISPLAY

The display section uses the signal generated by the microprocessor to provide data in a form which can be read by the operator. The display will also indicate over and under range conditions, units, response setting and battery charge level.

FUNCTION SELECTOR

The function selector consists of a three position switch and two push buttons which allow the user to control which readings the instrument will display (velocity or pressure, English or metric units).

POWER SUPPLY

The power supply section regulates the voltage supplied by the batteries.

BATTERIES

Power to the instrument is supplied by three C size rechargeable batteries.

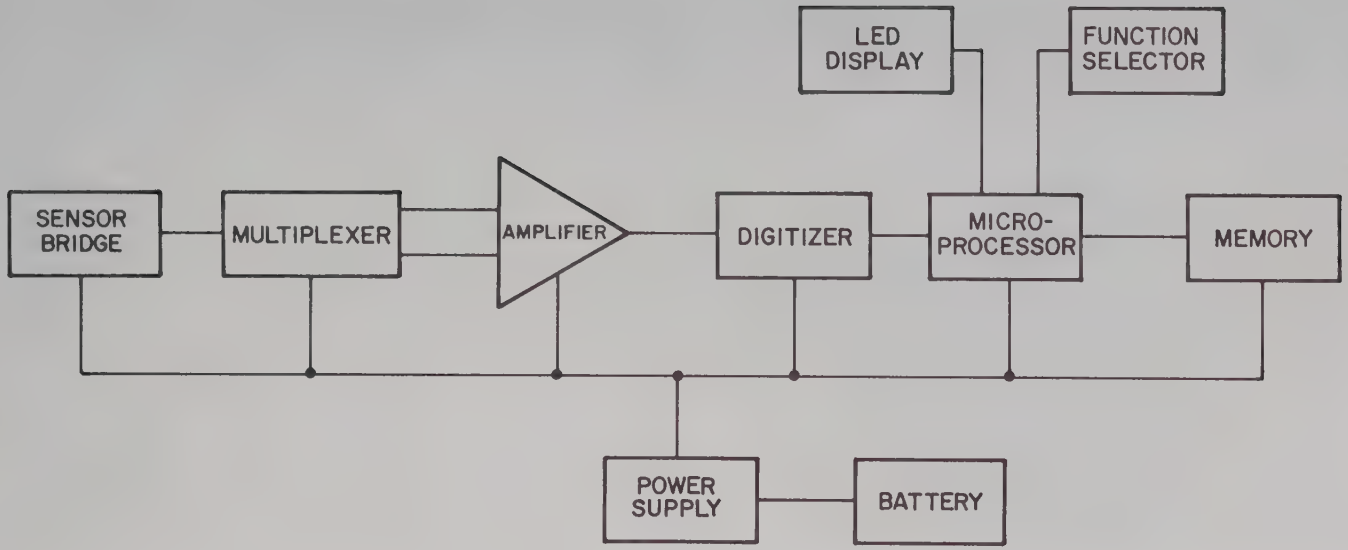


Figure 9. Block Diagram of Hardware

SPECIFICATIONS

INSTRUMENT DISPLAY	4-digit, 5/16" high LED's. Separate indication for FPM, m/s, H_2O, Pa, and HLD
PRESSURE RANGE	0 to 20 inches H_2O (0 to 5000 Pa)
VELOCITY RANGE	0 to 9990 FPM (0 to 91 m/s)
OPERATIONAL TEMPERATURE RANGE	0 to 122° F (-18 to 50° C) Accuracy not specified below 32° F
STORAGE TEMPERATURE RANGE	-40 to 150° F (-40 to 65° C)
OPERATIONAL HUMIDITY RANGE	5% to 95% RH at 40° C (non-condensing)
STORAGE HUMIDITY RANGE	5% to 95% RH at 40° C (non-condensing)
METER ACCURACY PRESSURE MODE (after zeroing)	± 1% of indicated reading ± resolution ± .06% of span per deg F (reference temperature 77° F)
VELOCITY CONVERSION ACCURACY	$4005 \times \sqrt{((\text{actual } H_2O \pm 0.005)}$ for FPM <2000, and $\pm 1.5\% \times 4005 \sqrt{(\text{actual } H_2O)}$ for FPM ≥ 2000 or $1.29 \times \sqrt{((\text{actual Pa}) \pm 1)}$ for m/s <10, and $\pm 1.5\% \times 1.29 \sqrt{(\text{actual Pa})}$ for m/s ≥ 10
PROBE ACCURACY	± 2% of indicated reading
RESOLUTION Pressure:	1 Pa (approx. .004 H_2O) from 0 to 1 H_2O 0.01 H_2O from 1 to 20 H_2O 1 Pa from 0 to 250 Pa 10 Pa from 250 to 5000 Pa (1 Pa in hold)
Velocity:	Meter resolution is dependent on meter velocity reading, and can be calculated using the following formula: In FPM: Resolution = $V - \sqrt{V^2 - 8.02 * 10^4}$ or 10 FPM, whichever is greater. In m/s: Resolution = $V - \sqrt{V^2 - 1.664}$ or 0.01 m/s, whichever is greater. (V = meter velocity reading)

BATTERIES	Three 1.2V C-size rechargeable 2200 mAH NiCd cells
BATTERY RECHARGE TIME	12 to 14 hours
BATTERY LIFE	6 hours minimum service with new, fully-charged batteries (without optional MicroPrinter in use)
INSTRUMENT DIMENSIONS	3″ x 4″ x 8.5″ (77x102x216 mm)
INSTRUMENT WEIGHT	1 lb. 10 oz. (809 grams) with batteries
CARRYING CASE	Black plastic, foam padded; 17 1/4″ x 4 5/8″ x 14″ (430x117x356 mm) with handle
PITOT-STATIC PROBE	12″ (305 mm) insertion depth, .312 (8 mm) tube diameter, 1/4″ (7 mm) port diameter
PRINTER PORT	For use with ALNOR CompuFlow MicroPrinter P/N 638-493-000 or RS232 Interface Module P/N 639-000-000

TIME CONSTANTS
(Pressure mode)

Setting	Time to reach 95% of input (seconds)	% Override of display
.0.0.1	5	0
.0.0.2	5	50
.0.0.3	10	50
.0.0.4	10	100
.0.0.5	10	200

Note: The % Override indicates the value that the input must reach to allow the meter to be instantly updated.

To most closely approximate the response time of a typical inclined oil-filled manometer having a range of one inch, use response setting of .0.0.4 or .0.0.5.

MAXIMUM OVERPRESSURE	Maximum pressure differential 5 psi (138 in. H_2O, 34470 Pa)

Specifications subject to change without notice.

1. a. Telephone Alnor Instrument Company Repair Department 312-677-3500 for cost of repair or recalibration, Authorization For Repair (AFR) number and shipping instructions.

WARRANTY/REPAIR INFORMATION FORM

Contact Alnor Instrument Company before returning your Alnor Instrument to the factory. See INSTRUCTIONS FOR RETURN. Follow the procedure carefully as it will expedite processing. Failure to follow the procedure will/may cause return of unit unrepaired. Send your instrument to the factory transportation prepaid. To assure fast turn-around time, fill out this form with as much detail as possible and attach it to the instrument.

Instrument Model _____

Serial Number _____

Date of Purchase _____ Where Purchased _____

Describe malfunction _____

_____

_____

_____

Describe environment _____

_____

_____

_____

Return instrument to:

Name _____
(Your name or company)

Address _____

_____

Telephone _____

Address Correspondence to:

Name _____

Address _____

_____

Telephone _____

INSTRUCTIONS FOR RETURN

Damaged in Transit

All shipments are carefully examined by Alnor Quality Assurance and carefully packed for shipment. On receipt, if the shipping container appears to have been damaged during shipment, the instrument should be thoroughly inspected. The delivering carrier's papers should be signed noting the apparent damage.

If the instrument itself has been damaged, a claim should be promptly filed against the carrier by the customer. The selling agent will assist the customer by supplying all pertinent shipping information; however, the claim must be filed by the insured.

If the instrument is damaged beyond use, a new order should be placed with Alnor while awaiting reimbursement from the carrier for the damaged instrument.

Call Alnor directly for assistance if necessary.

Malfunction

Please follow these steps should you require factory service or repair of your Alnor Instrument:

1. Write or telephone the Alnor distributor in your country for cost of repair or recalibration and shipping instructions. Obtain a Purchase Order or purchase order number from your Purchasing Department showing instrument model number and cost of repair and/or recalibration. Securely package your instrument in a strong container surrounded by at least two inches (5 cm) of suitable shock-absorbing material. Include the Purchase Order, or Reference the Purchase Order on your packing slip.

2. In North America, telephone the Repair Department at the USA factory for cost of repair or recalibration, Authorization for Repair (AFR) number, and shipping instructions. On instruments being returned to the factory for recalibration, determine whether you prefer:

   --Certificate of Calibration, no data (states instrument checked and found to be within accuracy claimed and specifications listed in current literature).

   --Certificate of Traceability to National Institute of Standards and Technology (NIST, formerly NBS) with data (states instrument compared with factory standard traceable to NIST, lists of calibration data, i.e., "Standards reads..." and "This instrument reads...")

   Obtain a Purchase Order or purchase order number from your Purchasing Department showing instrument model number and cost of repair and/or recalibration. Securely package your instrument in a strong container surrounded by at least two inches (5 cm) of suitable shock-absorbing material. Include the Purchase Order, or Reference the Purchase Order on your packing slip. Mark the outside of the shipping container with the AFR Control number.

3. Forward the instrument prepaid. See back cover for factory addresses.

Please note that instruments received improperly marked or without an accompanying Purchase Order may be returned at your expense. Please also note that if an AFR# has been assigned, it will be cancelled if the instrument is not received by ALNOR within 60 days.

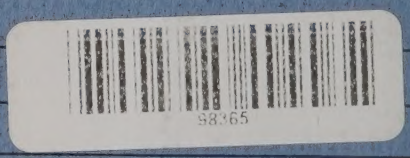
Equipment Log
MODEL _____

DATE OF
PURCHASE _____

CALIBRATION RECORD

1. _____	2. _____	3. _____
4. _____	5. _____	6. _____
7. _____	8. _____	9. _____
10. _____	11. _____	12. _____

Notes: _____



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